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# Industrial wireless sensor networks 2016

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Arumugam Nallanathan<sup>5</sup>**

The industrial wireless sensor network (IWSN) is the next frontier in the Industrial Internet of Things (IIoT), which is able to help industrial organizations to gain competitive advantages in industrial manufacturing markets by increasing productivity, reducing the costs, developing new products and services, and deploying new business models. The IWSN can bridge the gap between the existing industrial systems and cyber networks to offer both new challenges and opportunities for manufacturers.

In the next few years, as the edge part of IIoT, the IWSN plays a crucial role in transforming industrial organizations opening up a new era of economic growth and competitiveness in digital industrial 4.0. The IWSN presents great benefits to industrial organizations such as profitability, efficiency, productivity, reliability, and safety mainly through three aspects: (1) boost revenues by increasing production, (2) develop new hybrid business models, and (3) exploit intelligent technologies to fuel innovation.

However, there are still many challenges for the IWSNs: (1) it involves many separate technology families and bringing them together will take time, and (2) there are still many technical barriers to merge different business functions under different technical standards/vendors.

One of the goals of this Special Issue was to gather researchers from different industrial areas, such as industrial wireless sensors, machine-to-machine communications, and industrial applications and build on the emerging digital industrial 4.0. In the paper “Connectivity node set generation algorithm of mine WSN based on the maximum distance” authored by Ke Wang and Donghong Xu, the deployment strategy of IWSNs in a coal mine scenario is investigated based on the energy consumption, survival time, and quality of services. A connectivity node set generation algorithm of mine IWSN-based  $n$  maximum distance is

proposed and the proposed strategy is tested in a coal mine monitoring system.

Location-based service (LBS) is one of the most important topics in industrial applications; the second paper “Indoor localization based on subarea division with fuzzy C-means,” authored by Junhuai Li, Jubo Tian, Rong Fei, Zhixiao Wang, and Huaijun Wang, presents a fingerprint localization model by dividing the target area into multiple sub-areas with fuzzy C-Means algorithm. In this solution, the noise and non-linear attenuation between the wireless signals are considered to improve the accuracy.

Energy consumption and routing algorithms remain two active topics for resource-constrained nodes in IWSNs. In the paper “Relay participated–new-type building energy management system: an energy-efficient routing scheme for wireless sensor network–based building energy management systems” by Kewang Zhang, Qizhao Wu, and Xin Li, a novel energy-efficient routing scheme is proposed based a new strategy: relay participated–new-type building energy management system (RP-NTBEMS). The new scheme can reduce the energy consumption and extend the lifetime of IWSN nodes and the simulation result shows that the proposed RP-NTBEMS can obtain better performances

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than the most commonly used AODV and LEACH with lower energy consumption.

In the paper “Weight-based link scheduling for convergecast in WirelessHART network,” Dr Kewang Zhang et al. investigated a high robust communication protocols WirelessHART. The proposed link schedule scheme can improve the reliability of the links between nodes in IWSNs.

Security and reliability remains an important topic in IWSNs. The paper “Cumulated checksum and dynamic addresses for secure wireless sensor networks,” authored by Qiong Zhang, focuses on secure solutions for IWSN. A secure ARQ scheme (Sec-ARQ) is proposed for IWSN data link layer that protects frame

checksum and addresses without using computation expensive key-preshared authentication. This is a new security solution for IWSN that can significantly reduce computation on resource-limited nodes.

In application layer of IWSN, developing new business models for new applications is an emerging topic that attracts many research efforts. In the paper “Online auction-based resource scheduling in grid computing networks,” Lili Ding, Long Chang, and Lei Wang investigated the auction-based algorithm for grid computing and proposed a reverse online auction method to allocate grid resources in IWSNs. The proposed schemes can be helpful in developing new industrial applications.